REMARKS

The Office Action dated December 3, 2001 has been carefully considered and this Amendment and Reply prepared in response.

The Office Action contains several objections and rejections. The drawings were objected to under 37 CFR 1.83(a) for failing to show every feature of the invention specified in claim 3. The specification was objected to under 37 CFR 1.71 as being so incomprehensible as to preclude a reasonable search of the prior art by the examiner for not clearly describing where magnetic resistances are formed. Claims 3-6 and 9-10 were rejected under 35 U.S.C. 112, first paragraph, as containing subject matter not described in the specification because the specification does not clearly describe where magnetic resistance is formed. Claims 1-2, 7-8, 11 and 15-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,936,32 to Koide et al. in view of U.S. Patent No. 5,668,430 to Kolomeitsev. Claims 12-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Koide reference in view of the Kolomeitsev reference and in further view of U.S. Patent No. 5,418,413 to Satomi. Claims 17-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Koide reference in view of the Kolomeitsev reference as applied to claim 1 and in further view of U.S. Patent No. 4,785,213 to Satake. These objections and rejections are addressed under separate headings below.

Amendment to Fig. 9 Addresses Objections and Rejection Under 35 U.S.C. 112

Fig. 9 is proposed to be revised as shown in red on the attached figure. This revision adds a reference "1C" to identify a wall portion that is referenced in the first full paragraph on page 11 as amended. Since the reference number points to a presently shown structure, no new matter is added by this revision. As is more fully discussed below, this revision to Fig. 9 further clarifies how and where the magnetic reluctance between adjacent cores is set greater than between the two sets of cores.

Amendments to the Specification

The first full paragraph on page 11 of the specification is amended to add a cite to the reference number added to Fig. 9. This amendment does not add new matter.

The third full paragraph on page 11 of the specification is amended to replace the word "resistance" with the word "reluctance." The proper term for the well known property of matter and space that resists magnetic fields of force is "reluctance". *See, e.g.*, Van Nostrand's Scientific Encyclopedia, 6 ed., p.1805 (1983); CRC Handbook of Chemistry and Physics, 54th ed., p F-103 (1973). Since one of ordinary skill in electrical engineering would recognize "magnetic resistance" in the context of the discussion on page 11 as properly referring to magnetic reluctance, these amendments do not add new matter.

Amendment to Claim 3

This amendment replaces the word "resistance" with the proper technical term "reluctance" to be consistent with the amendments made on page 11 of the specification.

New Claims 20 and 21

New claim 20 is supported by the disclosure in the specification provided on pages 10 - 13 and in Figures 8 – 10. In particular, this claim is supported by the first full paragraph on page 11 (as amended).

New claim 21 is supported by the disclosure in the specification provided on page 5 of the specification and in Figure 1 (structure 30(A)).

Objection to Drawings Under 37 CFR 1.83(a) is Traversed.

In the Office Action, the Examiner objects to the drawings under 37 CFR 1.83(a) for failing to show magnetic resistance between adjacent core units that is recited in claim 3. This objection is traversed because Fig. 9 in fact shows structure supported by disclosure in the specification that provides for enhanced magnetic reluctance between adjacent cores which supports claim 3 as amended.

On page 11, the specification (after amendment) in the third and fourth full paragraphs explains that "magnetic reluctance between adjacent cores in a circumferential periphery should be much greater than the magnetic reluctance passing through the third cores 13 between first cores 11 and second cores 12 of the same phase." In the amendments, the word "resistance" is replaced with the proper term

"reluctance". *See,* Scientific Encyclopedia, at 1805. As is well known, magnetic lines of force flow more readily through magnetic metals, which have low magnetic reluctance, than through non-magnetic materials, air or vacuum, which have high reluctance. *See, id.* Thus, it is well known that to increase magnetic reluctance between two regions, an air gap (even just a small open space) or a piece of non-magnetic material can be provided between the two regions. *See, id.* The fourth paragraph on page 11 explains that this approach may be used in the disclosed embodiment. The fourth paragraph goes on to point out that the retaining plates 18, which fit within the gaps (unlabeled) between the cores should be of a non-magnetic material. Supporting this disclosure is Fig. 9 which shows similar structures in cores 11 (e.g., gaps in the winding slots and retaining plates, both not labeled), and in cores 13 (e.g., coolant channels 40, 41 and bolt holes 42). Also, the first full paragraph (as amended) on page 11 states that a "wall 1C of the case made of non-magnetic material is interposed between adjacent third cores," which is clarified by the addition of reference "1C" in the proposed drawing change. Note, that it is easier to see the path that magnetic flux will follow in passing from cores 11 through cores 13 and into cores 12 by referring referring to Fig. 8.

Finally, drawings need not depict invisible forces, such as magnetic flux, since forces are not structure. Representation of the lines of magnetic force in this complex motor/generator would unnecessarily complicate and confuse the figures. Moreover, since reluctance is a property of a volume, and not even a force field, it is not possible to represent it the figures. However, if it will expedite allowance of the claims, Applicant is willing to add reference numerals to Fig. 9 indicating gaps and non-magnetic materials in the first, second and third cores and to amend the fourth full paragraph on page 11 to cite the references. Such revisions and amendments would not add new matter.

Thus, with the proposed revision to the drawing identifying a wall on non-magnetic material as "1C", Applicant submit that the structure shown in Fig. 9, when viewed in the context of the disclosure on page 11 of the specification (as amended) and the general knowledge of one of ordinary skill in the art, properly illustrates all

features of the claimed invention. Accordingly, withdrawal of the objection under 37 CFR 1.83(a) is respectfully requested.

Objection to the Specification Under 37 CFR 1.71 is Traversed.

In the Office Action, the Examiner objects to the specification under 37 CFR 1.71 for being so incomprehensible as to preclude a reasonable search, because paragraph 4 on page 11 does not clearly describe where magnetic resistances are formed. Based upon the amendments to Fig. 9 and to the specification on page 11 described above, the Applicant respectfully disagrees for the following reasons.

As described above, it is well known that non-magnetic materials and gaps in a path, even small air gaps, increase magnetic reluctance compared to a path through magnetic materials. *See*, Scientific Encyclopedia, at 1805. On page 11 of the specification, the fourth full paragraph (which starts with "This requirement") explains that the requirement for increased reluctance between adjacent cores can be achieved by placing a space between adjacent cores or sandwiching a non-magnetic member between adjacent cores. That paragraph further explains that the retaining plates should be non-magnetic for the same reason. Referring to Fig. 9, a gap (absence of structure) is clearly shown between adjacent cores 11 and between adjacent cores 12. The location of this gap is further emphasized by the presence of the retaining plates 18 at the base of these gaps. Further, the amended first full paragraph on page 11 (beginning with "A wall") clearly describes structure of a non-magnetic material positioned between the adjacent cores 13. Thus, the combination of the amended disclosure on page 11 and the structures disclosed in revised Fig. 9 both explains how to increase the reluctance between adjacent cores ,and provides written and visual examples of structure that satisfies this requirement.

Note, while Fig. 9 clearly shows structure that increases magnetic reluctance between adjacent cores, Fig. 8 shows structure that provides reduced reluctance within the volume passing between cores 11 and 12 through cores 13. The bottom half of the longitudinal cross-section view in Fig. 8 shows how there is a solid path of magnetic material in cores 13 that provides a path of low magnetic reluctance between cores 11 on the left side and cores 12 on the right side. Thus, Figures 8 and 9 together, in combination with the explanation on page 11, clearly describe to one of

ordinary skill in the art how structures between the cores provide increased reluctance in the volume between the cores compared to the reluctance along the path from cores 11 through cores 13 to cores 12 and back.

With the amendments to the specification and Fig. 9, the Applicant considers that the specification is clear and in compliance with 37 CFR 1.71. Accordingly, the Applicant respectfully requests withdrawal of the objection to the specification.

Rejection Under 35 U.S.C. § 112, First Paragraph, Is Resolved By The Amendments

In the Office Action, claims 3 – 6 and 9 – 10 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter not described in the specification. The Examiner stated that the phrase relating to magnetic resistance cannot be understood because the "magnetic resistance positions cannot be pointed out where they formed in order to compare from one to another." Based upon the amendments to Fig. 9, the specification and claim 3, this rejection is respectfully traversed.

As explained above, revised Fig. 9 and the associated paragraphs on page 11 of the specification, as amended, would communicate to one of ordinary skill in the art how and where magnetic reluctance should be increased to prevent leakage of magnetic flux.

As is well known (*see* Scientific Encyclopedia, p. 1805), reluctance is a characteristic of a volume (or path through a volume) that is inversely proportional to the amount of magnetic flux in the volume for a given applied magnetic field. Thus, the amended claim language "a magnetic reluctance between adjacent core units is set to be greater than a magnetic reluctance between the first core and the second core of the same core unit" clearly refers to a measurement of the reluctance in the volume or path between adjacent cores compared to a measure of the reluctance in the volume or path between the first core and the second core of the same core unit. As explained above, the volumes or paths are clearly illustrated in Figures 8 (showing the path between the first core and the second core of the same core unit) and 9 (showing the path between adjacent cores).

Further, as the discussion above explains, the disclosure on page 11 of the specification, when read with reference to Figures 8 *and* 9, clearly discloses that the magnetic flux is directed between associated (same core unit) poles in cores 11 and 12 through cores 13 (see Fig. 8) and mitigated between adjacent cores (see Fig. 9).

Based upon the above, the Applicant respectfully submits that the objected to phrase in claim 3 is clear to one of ordinary skill in the art upon reference to the specification and the figures, and therefore claim 3 as amended is patentable. Accordingly, the Applicant respectfully requests withdrawal of the rejections under 35 U.S.C. § 112, first paragraph, for claim 3 and for the claims depending therefore (claims 4 – 6, 9 and 10).

Rejections Under 35 U.S.C. § 103 Are Traversed Because The Cited References Do Not Disclose the Claimed Inventions.

The Office Action rejects the pending claims under 35 U.S.C. § 103 over the Koide reference in combination with the Kolomeitsev, Satomi and Satake references. These rejections are traversed because the references do not disclose or suggest the structures recited in the pending claims. The differences between the claims and the references are described more fully below.

First, the Koide reference does not teach a single current control device that supplies a composite current comprising the first alternating current and the second alternating current to the coils. The motor/generator according to Koide et al. shown in FIGs. 20 and 21 is provided with two current control devices, each of which is independent from each other, i.e., the first driving circuit 191 and the second driving circuit 192. The first driving circuit exclusively drives the first motor MG1, while the second driving circuit exclusively drives the second motor MG2. More specifically, the three power lines from the first driving circuit are connected only to the three-phase coils 134 of the first motor MG1, and three-phase (U-phase, V-phase and W-phase) alternating current is provided through these power lines only for the purpose of driving the rotor 132 of the first motor MG1. Similarly, three power lines from the second driving circuit are connected only to the three-phase coils 144 of the second motor MG2, and three-phase (U-phase, V-phase and W-phase) alternating current is provided

through these power lines only for the purpose of driving the rotor 142 of the second motor MG2.

In contrast, in the first embodiment of the present invention shown in FIGs. 1 - 3, twelve power lines from a single inverter 112 are respectively connected to twelve coils 16, and a composite current (e.g. a-phase current + u-phase current) of the first multi-phase alternating current (e.g., a-phase current, b-phase current, c-phase current and d-phase current) for driving the first rotor 2 and the second multi-phase alternating current (e.g., u-phase current, v-phase current and w-phase current) for driving the second rotor 3 are provided through these twelve power lines. These features related to the composite alternating current are disclosed in the thirteenth line on page 6 through the second line on page 7 of the specification. A single current control device supplying such a composite alternating current enables driving the two rotors independently from each other and represents a significant advantage of the present invention.

Koide does not teach nor suggest such a feature at all.

Second, the motor according to Kolomeitsev is provided with only one rotation shaft 28, and the two portions 34a, 34b of the rotor 14 rotate synchronously with the shaft 28. Its construction is therefore much different from that of the motor/generator according to the present invention that is provided with two rotation shafts to permit relative rotation of the first rotor and second rotor. Further, in the second portion 34b according to Kolomeitsev, one center tooth 38 and two side teeth 40 form one magnetic pole 32. As a result, the number of magnetic poles is the same, that is, the number of poles that the center teeth 38 form is ten, while the number of magnetic poles that the whole of the side teeth 40 form is also ten. Thus, Kolomeitsev would not suggest to one of ordinary skill in the art that the number of poles may be different between the first and second rotors.

In contrast, Claim 1 recites that the number of the magnetic poles of the first rotor and the number of the magnetic poles of the second rotor are different. Thus, the structure of the first rotor and second rotor recited in the Claim 1 of the present invention is not disclosed or suggested in Kolomeitsev.

Based upon the above, it is clear that, even if the teachings of Koide are combined with those of Kolomeitsev, the claimed features of Claim 1 of the present invention will not be realized. Thus, Claim 1 is believed to be patentable over the combination of Koide and Kolomitsev. Similarly, the structure recited in claim 17 is not disclosed in any combination of the Koide, Kolomeitsev and Satake (which is relied upon only for the winding of stators) references. Thus, claim 17 is also considered patentable.

Since the independent claims 1 and 17 are considered patentable, each of the dependent claims is also considered patentable for at least the same reasons. Thus, the remaining rejections relying upon the Satomi and Satake references need not be addressed.

New Claims 20 and 21 are Considered Patentable.

New claim 20 depends from allowable claim 2, which depends from allowable claim 1. Accordingly, new claim 20 is also considered to be allowable for at least the reasons advanced above.

New claim 21 depends from allowable claim 1. Further, claim 21 recites structure (needle bearing between the first and second rotation shafts) that is not disclosed in any of the cited references. Accordingly, new claim 21 is considered to be allowable.

Conclusion

Based upon the above, Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Atty. Dkt. No. 040356/0316

Respectfully submitted,

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Should additional fees be necessary in connection with the filing of this paper, or if a petition for extension of time is required for timely acceptance of same, the Commissioner is hereby authorized to charge deposit account No. 19-0741 for any such fees; and applicant hereby petitions for any needed extension of time.

Version of Amended Paragraphs and Claims Showing Changes Made

Page 11, first full paragraph:

A wall **1C** of the case 1 made of a non-magnetic material is interposed between adjacent third cores 13.

Page 11, third full paragraph:

Therefore, leakage of magnetic flux between adjacent second cores 12 and adjacent first cores 11 must be suppressed to low levels. In other words, magnetic ~~resistance~~ **reluctance** between adjacent cores in a circumferential periphery should be much greater than the magnetic ~~resistance~~ **reluctance** passing through the third cores 13 between first cores 11 and second cores 12 of the same phase.

Claim 3:

3. (Amended) The motor/generator as defined in Claim 2, wherein the stator is provided with a plurality of core units separated in a peripheral direction, each core unit is provided with a first core facing an outer periphery of the first rotor and a second core facing an outer periphery of the second rotor and magnetically connected with the first core, and a magnetic ~~resistance~~ **reluctance** between adjacent core units is set to be greater than a magnetic ~~resistance~~ **reluctance** between the first core and the second core of the same core unit.